iWire365
Redefining Communication Infrastructure

Smart Grid Wireless Communications Planning Guide

iWire365
Connecting the World One Community at a Time
SMART Energy, Government
Public Safety, Telecommunications,
Business & Home

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Smart Grid Wireless Communications Planning Guide

The creation of a high-speed wireless broadband network for utilities will provide reliable high-speed backhaul that can be used for advanced metering infrastructure, provide last mile and mobile wireless Internet connectivity (City-wide and Countrywide broadband wireless access), and other business-critical data from substations, both local and remote, through a combination of wireless technologies tied into microwave and fiber based network.

Such a solution will utilize an all-IP wireless broadband network using a combination of wireless technology providers. Both point-to-point and point-to-multipoint technologies can be deployed using a combination of both licensed and unlicensed frequencies. Creating a multi-platform transmission system, the IP network can be used not only to carry mission-critical data, but also for other crucial functions such as connecting two-way radios system repeater sites, and supporting advanced surveillance systems.

In order to create a reliable commnications platform for utility operations a wireless backhaul network will serve as the network's foundation. In lieu of many utilities not having fiber optics and lack of high speed connectivity, the creation of a wireless backhaul network utilizing microwave will accomplish the need for high-speed connectivity to support an all-IP wireless broadband network.

Utility Future State Wireless Broadband Capabilities

Wireless is increasingly becoming the solution of choice. Wireless is the ideal solution in any situation where wire is difficult or impossible to install either physically or economically. This includes not only the installation of networks in structures that are not readily amenable to wiring, but also situations where networks must be rapidly deployed, are subject to ongoing modifications, changes, and upgrades, and where post-installation flexibility is otherwise required. And also included are outdoor installations where provisioning wire, cable, or fiber involves hanging these on poles, digging up streets, or related expensive, time-consuming activities. Time-to-solution is universally better in the case of wireless.

For many years, wireless could not compete with the throughput and quality-of-service capabilities of wire. This has now changed, and radically – for example, wireless LANs based on the 802.11n standard in both indoor and outdoor applications offer much higher throughput than 100 Mbps Ethernet. Outdoors, wireless links capable of bridging several kilometers can yield throughput well in excess of 1 Gbps, and today have the management capabilities required to effectively plan, configure, install, monitor, and report on all elements of an operational broadband wireless solution. All of this means that wireless systems are highly competitive with wired solutions based on xDSL, cable modems, optical fiber, and metro-area Ethernet services.

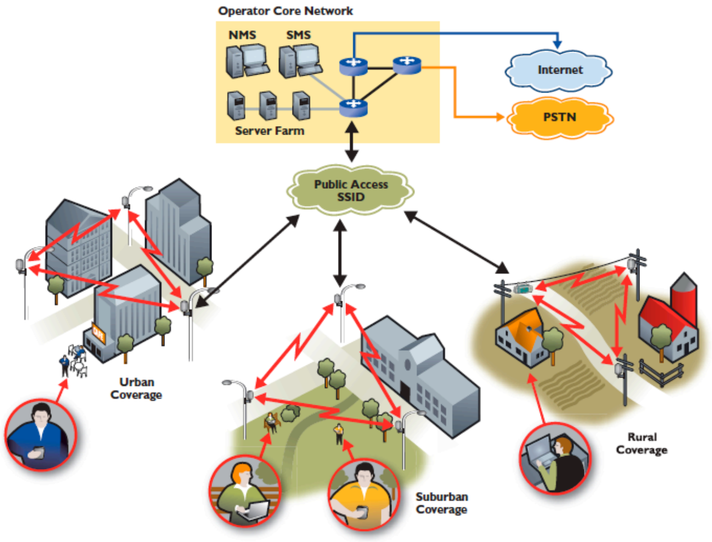
Early wireless links were lucky to yield a few kilobits per second. But today's high level of throughput available, coupled with support for time-bounded communications like voice telephony and real-time (and even two-way) video based on IP (often called IPTV), mean that wireless solutions effectively duplicate the capabilities of wire, and often, as we'll see below, exceed them on a price/performance basis. In other words, an appropriate wireless solution can support any application today, and at a price that is more than competitive (and often very significantly better) than that of wire. An application with increasing importance is the provisioning of video for law enforcement, utilities and surveillance applications – no longer a challenge to wireless solutions.

The creation of a high-speed wireless broadband network for utilities will provide backhaul for advanced metering infrastructure, provide last mile and mobile wireless Internet connectivity (City-wide and Countrywide broadband wireless access), and other business-critical data from substations, both local and remote, through a combination of wireless technologies such as WiMAX and Wi-Fi tied into microwave and fiber based network.

Such a solution will utilize an all-IP wireless broadband network using a combination of wireless technology providers. Both point-to-point and point-to-multipoint technologies will be deployed using a combination of both licensed and unlicensed frequencies. Creating a multi-platform transmission system, the IP network can be used not only to carry mission-critical data, but also for other crucial functions such as connecting two-way radios system repeater sites, and supporting advanced surveillance systems.

Technologies to be considered include a combination of unifying Wi-Fi, LTE, WiMAX, Microwave, and Cellular.

Integration is the key concept in wireless broadband to support all kinds of applications by offering single access to all wireless networks. Understanding the significance of unifying Wi-Fi, LTE, WiMAX and Cellular networks into one product, as the proposed solution is an important factor of wireless broadband that will be "seamless integration of wireless networks" based on flexibility of the software radio technology, bandwidth capacity, and routing techniques allowing multi-hop peer-to-peer networks. It is critical that future wireless technology will be capable of effortlessly accessing all kind of radio communications.



Public Works / Utility Applications

Ubiquitous, secure wireless coverage allows utilities to greatly improve employee efficiency, replace costly wire line connections, and reduce the operating costs of delivering utilities services in two key areas: employee mobility and automation of unattended services.

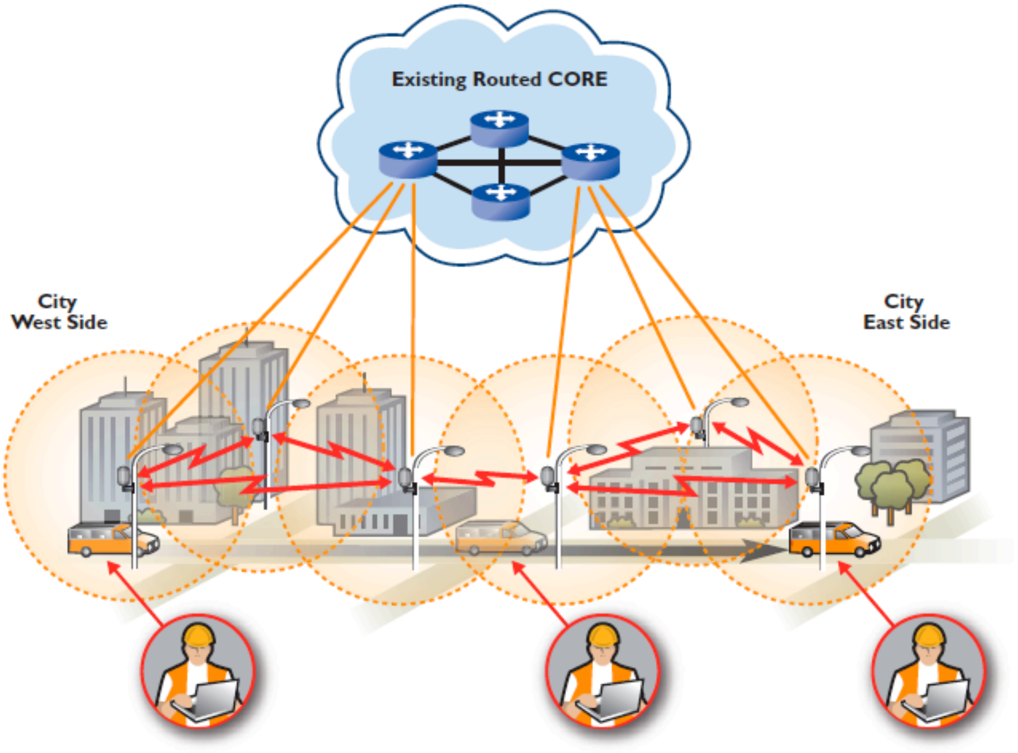
A broadband wireless mesh network enables utilities to arm its employees in the field with mobile applications running on Wi-Fi equipped laptops and/or handhelds, greatly improving their efficiency and responsiveness:

- **Mobile employee applications** — utility employees who spend most of their time in the field can be equipped with mobile applications on wireless laptops and handhelds, allowing them to make much more effective use of their time and be more responsive to citizens and businesses. These employees may conduct business, access centralized databases, and file reports from the field without returning to office, increasing the number of calls they can make per day. Field-based collection and wireless transmission of data eliminates the duplication of effort and transcription errors entailed by manual data collection in the field followed by data entry at the office. The capture and attachment of video and still images can greatly improve the efficiency and collaboration of casework (e.g., site inspections) requiring follow-up by multiple employees.

- **Fleet and maintenance crew dispatch** — Utility repair and maintenance crews for services can more effectively be scheduled, dispatched, monitored, and redeployed in real-time. Crews can file status updates and reports from the field, and access helpful information from centralized databases, without having to physically return to base.

- **Mobile employee instant messaging, email, and voice —** Utility employees can reduce cell phone costs and collaborate more effectively by using Internet-based communications tools (VoIP, IM, and email) from their wireless-equipped laptops and handhelds in the field. These mechanisms can serve as useful communications back channel as well as a backup in the wake of disasters that knock out cell phone service (Wi-Fi services are usually restored much more quickly). They also provide a highly interoperable means of inter-departmental and inter-agency communications compared to proprietary, often-incompatible private mobile radio systems.

- **Employee telecommuting** — Utility employees telework from home during off-hours, on flex-time, and during weather emergencies or disasters.



Strengths of Wireless Broadband & Wi-Fi in Rural Areas

Perhaps the most important thing about wireless broadband and Wi-Fi is that it is wireless that has the ability to offer high-speed wireless Internet services to Utility Members. Citizens of rural towns and areas might not initially care if their Internet access is wired or wireless as long as they get access. Before Wi-Fi came along, wired was the only option, but it was not a very cost effective option for rural communities due to the remote areas to which wires would need to be extended and the long distances to be covered. When Wi-Fi came along, it presented a relatively cheap alternative for rural America to access the Internet.

Use of Wi-Fi in Rural Areas

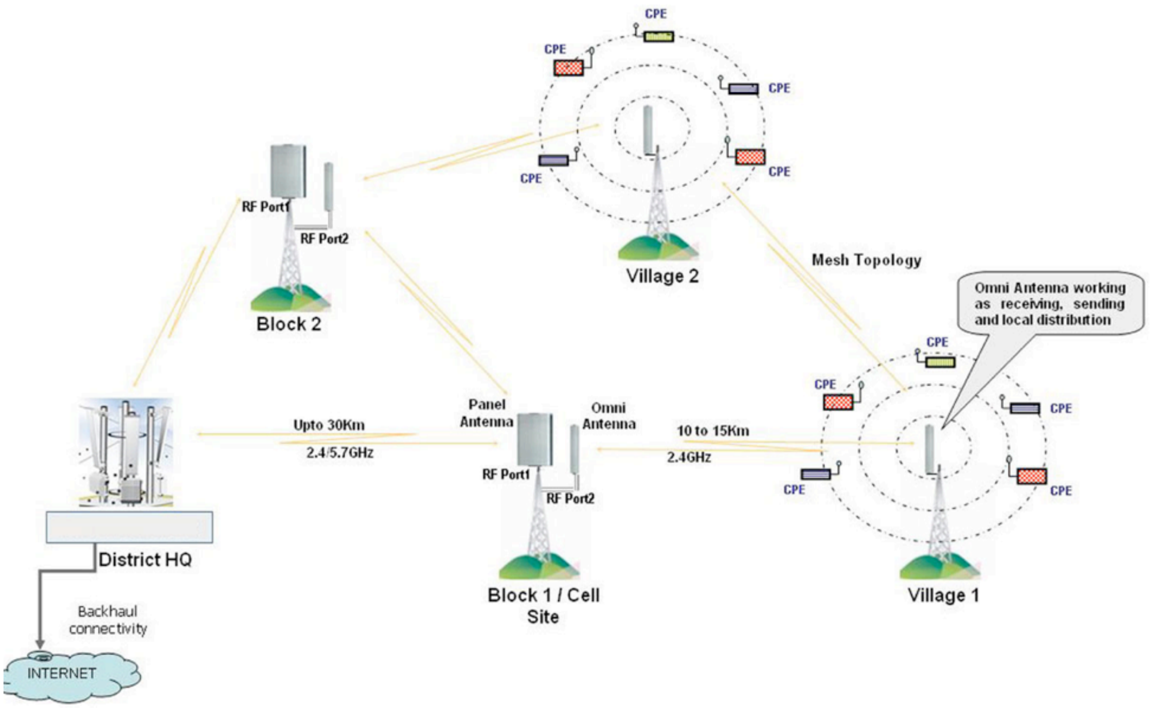
Because Wi-Fi lacked power and range, yet was the first available wireless Internet service, it had limited use and acceptance in rural America. Some companies jumped at the chance to use this new wireless technology, and some even decided it was economical enough to use in rural areas. Wi-Fi was their first real opportunity to make quality Internet available to rural America. A real example of such a company is Columbia Energy of the Columbia Rural Electric Association. Columbia Energy provides Internet services to homes and businesses and gives farmers access to a network they can use to monitor irrigation, all through use of Wi-Fi technology. The service is centered in Walla Walla County, Washington, where a series of towers each with a 30-mile range were set up to cover 1500 square miles.

LTE & WiMAX Technology

LTE & WiMAX (4G) shares Wi-Fi's strength of not requiring expensive wires and cables and of allowing for even cheaper use of unlicensed spectrum. Plus, 4G provides additional range. Wi-Fi provides coverage of kms, but 4G offers a range of tens of kms. An increase in range is particularly important in the densely populated areas of rural America since the number of people covered by a single tower is rather small compared to an urban area no matter what the range of the tower and having a tower that increases the number of households serves cuts down dramatically on costs and encourages service providers to establish themselves in rural communities.

Just like Wi-Fi, 4G is an economically feasible option for rural America even if it doesn't yield the profits in rural areas that it yields in urban areas. 4G also offers data rates higher than 802.11a, 802.11b, and 802.11 g.

4G for it allows the ability to combine a variety of different wireless technologies. 4G is the ideal solutions for utility for long-range wireless microwave data transmission instead of using fiber, wireless point-to-multipoint connectivity to provide connectivity to remote site locations and connectivity to mobile workers and connection surveillance equipment, and combining 4G and Wi-Fi in tandem to provide wireless broadband Internet services to utility employees and members.



Utility Future State: Delivering Wireless Broadband Technology

- Connecting Wi-Fi hotspots to the Internet.
- Providing a wireless alternative to cable and DSL / T1 for "last mile" broadband access.
- Providing data and telecommunications services.
- Providing high-speed wireless access for mobile users
- Providing a source of Internet connectivity as part of a business continuity plan. That is, if a business has both a fixed and a wireless Internet connection, especially from unrelated providers, they are unlikely to be affected by the same service outage.
- Automated Vehicle Location
- Wireless Building Inspections in the Field
- Code Enforcement / Neighborhood Improvement
- Document Management and Imaging System
- Emergency Disaster Response
- Emergency Notification
- Mobile Data Computers
- Mobile Work Order Management
- Video Conferencing / Communications
- Dual Mode WiFi/Cellular Smart Device
- Wireless Kiosks

Smart Grid Planning Considerations

The objective to creating a complete high-speed wireless broadband network for utility operations is to build the wireless backhaul via microwave.

Wireless backhaul is critical to facilitating the many applications required for a complete high-speed wireless network by providing back up for the speed and unlimited data download option.

Wireless backhaul accomplishes the following:

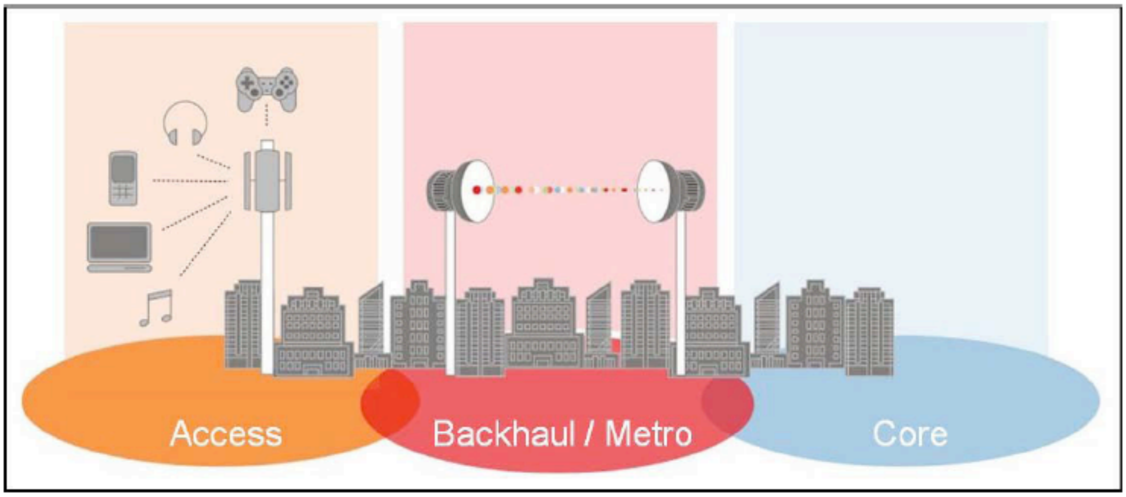
- Different campuses are interlinked without any mess of wires.
- Cellular towers are wirelessly connected reducing the carrier charges.
- Wireless backhaul has an edge over wired as it facilitates the large amount of audio / video data download.

The term “Last Mile Connectivity” is used to define Wireless Backhaul as it lends a hand to expand the wireless range even in distant locations.

Wireless backhaul has manifold prospects, as it is very easy to deploy because it needs no trenching and wiring, saving the time as well. Wireless backhaul need a very less infrastructure, so flexible to deploy anywhere. Without wiring and trenching it costs you a penny more than wired but a lot more benefits to enjoy.

When examining the wireless vs. wireline alternatives, fiber's nearly unlimited capacity immediately stands out. However, the fiber option is not always practical. Whether due to deployment restrictions (rough geographical terrain) or regulatory restrictions (dense metropolitan areas) laying out fiber infrastructure may be too costly and time consuming. In such cases, wireless, or more accurately - wireless backhaul based on point-to-point microwave, emerges as the best solution.

Microwave backhaul solutions are capable of delivering high bandwidth, carrier-grade Ethernet and TDM services. Microwave is suitable for all capacities up to several Gbps over a single link - and may be scaled up to multiple Gbps using aggregated links techniques. Unlike fiber, wireless solutions can be set up quickly and are much more cost efficient on a per-bit basis from day one.



It is the recommendation that utilities deploy a wireless backhaul network via microwave for reliable high-speed connectivity backhaul for operations.

Objectives to Begin a Potential Project: The first objective for utilities to deploy high-speed broadband wireless backhaul network is to create a wireless fiber ring. A wireless fiber ring, also know as wireless backhaul, is needed and required in areas where there is no fiber optic connectivity and/or high speed broadband. By deploying a wireless fiber ring through the Point-to-Point Microwave takes care of the issue of having to deploy fiber optics either in the ground or across existing infrastructure.

Point-to-Point Microwave provides two-way radio communication between both links from 5 to 40 miles, with an average of 20-mile hops with non-redundant links.

Creation of the wireless backhaul network will provide reliable high-speed wireless connectivity for utility operations especially in areas where there is lack of or no connectivity. The first objective of planning a Smart Grid Communications network is to conduct a feasibility study and fact finding exercise to determine the best wireless backhaul configuration to deploy, review and select the best wireless backhaul equipment and vendor(s), creation of an RFP / Bidding processes, development of a formal review of proposals / bids, and a process to selection a technology vendor that will deploy / installation othe wireless backhaul network.

The goal is to create a reliable wireless backhaul network for utility operations that can be used for the years to come and is compatiable and consistent with the requirement that the system be compatible with new technology such as LTE (Long Term Evolution) thus ensuring the utility investment is protected.

The scope of wireless backhaul project is a feasibility and fact-finding exercise and the outcome will be enough information for Management to make the next business decision.

Recommended Scope of Work: The Scope of work for the wireless backhaul network includes the creation and implementation of the following:

1. **Assessment of Feasibility** – Creation of a wireless backhaul plan that is viable for the utility
2. **Gathering of Requirements** – Identification of what type of wireless backhaul network utility needs
3. **Research & Refinement of Options** – Determination of what solutions and vendor will fit the utility’s needs
4. **Evaluation of Vendors** – Identification of the best fit for the utility’s needs
5. **Selection and Engagement of Vendor** – Formal review of whether or not the wireless backhaul network a reasonable price and best contract
6. **Management of Implementation** – Providing program management to ensure the selected vendor has delivered on its promises
7. **Support and Maintenance** – Creation of a service level agreement to provide ongoing maintenance and support of the wireless backhaul network.

STEP 1: ASSESING FEASIBILITY

Organizational Readiness – Consideration of the important elements to the project’s success such as getting buy-in from staff and overcoming technology fears and resistance to change.

Budgeting – Ensure the appropriate budget level to successfully execute on the project. Make sure that your budget can withstand reasonable variances from original estimates. Technology projects have varying degrees of financial risk based on the complexity of the project.

Staff Availability - Most technology projects require a significant investment of time. Utility staff will be involved in many stages of the process, such as requirements gathering, training, testing, and disruptions during deployment. iWire365 will serve as the project advocate to manage the vendor relationship and internal resources associated with the project. It is essential that the utility can commit time from appropriate staff members to make the project successful.

Sustainability – Ensure the proper resources in place to sustain the technology at the conclusion of the project. This could include budgeting for ongoing support, hiring a technology manager, or giving ownership of maintenance to a utility staff member and/or iWire365.

Return on Investment (ROI) – Determine whether or not the project is worth the investment. Questions to pose include, will it improve utility operations and/or lower costs?

Arriving at a Decision – After careful review of the aforementioned factors, a decision to move forward will be apparent.

Outcome of Step 1: These steps will provide a clear “go” or “no-go” decision.

STEP 2: GATHERING OF REQUIREMENTS

Review Business Strategy – Identification of the business goals to accomplish with this technology project.

Ensure Alignment – To ensure the application of technology will be an enabling factor and will not create a disruptive influence on the organization.

Process Mapping – Documentation of critical business processes the utility and iWire365 performs. This understanding will be critical for a vendor to understand how its solution should be implemented at the utility.

Process Re-engineering – Technology implementation often provides an opportunity to change the way certain business tasks are managed.

Requirements Analysis – Identification of critical requirements (such as number of users, current technologies in use, need for remote access, training, etc.) that will need to be part of the technology solution.

Prioritization of Requirements – Prioritization of a list of requirements to determine which ones are essential and which ones are “nice to have” but not required for success.

Environmental Assessment – Determination of environmental or physical location factors, to ensure a thorough assessment is conducted and all findings are documented.

Technical Assessment – Documentation of current technology and categorizations of areas that may interface with the new solution.

Outcome of Step 2: Requirements Document / Request for Proposal

STEP 3: RESEARCH & REFINE OPTIONS

Buy/Blend/Build – Determination of whether or not the solution can be categorized into one of three areas: Buy an off-the-shelf solution, Build a custom solution, or Blend a solution by combining an off-the-shelf product with some customization.

Establish Evaluation Criteria – Development of a set of criteria to evaluate prospective vendors.

Conduct Research – Utilization of current resources to learn more about existing products or solutions that could meet the utility needs. To involve the utility in the discussion of the project objectives with related organizations, trusted advisors, and technology consultants.

Define Targeted List – Based on requirements and research into solutions, creation of a short list of vendors who may be able to meet the utility's requirements. Size of the short list of vendors will correlate to variability in the proposed solutions and project complexity.

Creation / Send RFP – Creation of a formal RFP and then sending vendors the utility's requirement information and ask them to submit a proposal. Requirements will be sent in the form of a Request for Proposal (RFP) document.

Outcome of Step 3: Targeted List of Vendors / Solutions to Pursue

STEP 4: EVALUATE VENDORS

Evaluation Matrix – Development of an evaluation matrix to objectively evaluate each vendor's proposal and product demonstration.

Proposals – Each invited vendor should respond to the RFP with a written proposal. Careful evaluation of each proposal and encode the proposal information into the evaluation matrix.

Product Demonstrations – Evaluation of vendors via either in-person or web-based opportunity (a “demo”) to showcase their capabilities.

Reference Checks – Conduct direct contact with vendor's references as a part of your evaluation process.

Outcomes of Step 4: Vendor Proposals, Vendor Demos, and Weighted Vendor Matrix

STEP 5: SELECT & ENGAGE VENDOR

Primary and Secondary Options – The conclusion of the evaluation process will determine a primary option (winning vendor) and some secondary alternatives.

Negotiations – Continued dialog with secondary option vendors, as they will serve as a valuable resource in the negotiation process. While the negotiation process, secondary options will serve as the best alternative if negotiations fall through. The objective is to ensure the final deal created with the preferred vendor is at least as favorable as the secondary options.

Contracting – Identification of a clear set of objectives, deliverables, timeframes, and budgets for the project with the vendor. These will be clearly written in the terms of the contract.

Outcome of Step 5: Final Vendor Selected & Contracted

STEP 6: MANAGE IMPLENTATION

Dedicate Project Manager – One or more the utility / iWire365 staff members will oversee the solution implementation. Such individuals will have regular checkpoints with the vendor to ensure that delivery matches expectations.

Ensure Timely Delivery – Vendors often juggle many clients at once and as such it is important to keep track of deliverable dates and ensure that the vendor is meeting them.

Ensure On-Budget Delivery – If the utility / iWire365 negotiates a Time & Materials (T&M) contract with vendor, then it will become imperative to track hours spent and budgeted hours remaining on a project. Without careful consideration of these elements, project costs could spiral out of control.

Manage Scope – The greatest area of risk for the technology project is controlling project scope. Once an organization begins to see the possibility of technology, often times there will be an attempt to do too much in the initial development and launch of the solution. If this is the case, consideration will be taken with the project with the vendor a "Phase 1 deployment" and try to push back on new additions until a future phase. If a new addition is essential to a project, then it will be clearly defined in an addendum to the scope of work with additional negotiations with the price with the vendor.

Manage Expectations – Continual management of the expectations of all parties involved in the implementation support. Realistic timeframes will be provided with advance warning of any variances in budgets and timeframes.

Outcome of Step 6: On-time & On-budget Delivery of Expected Solution

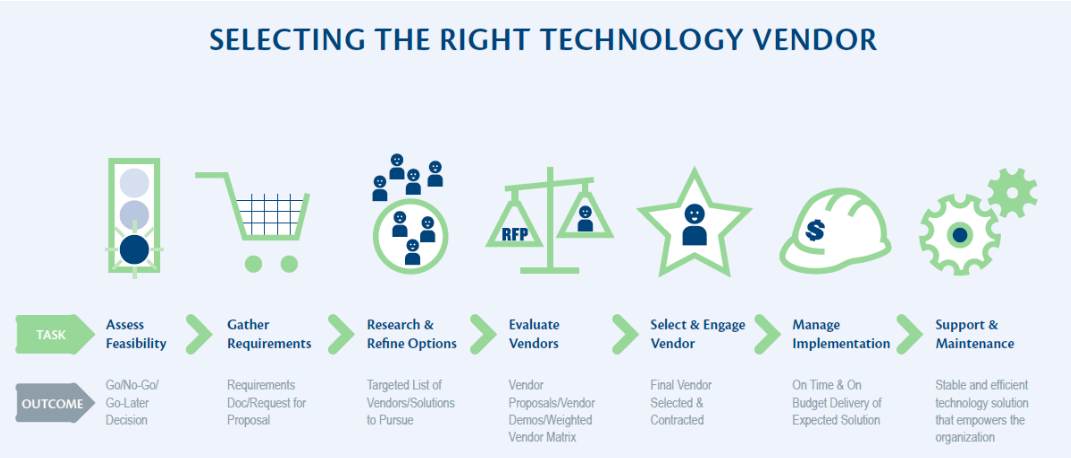
STEP 7: SUPPORT & MAINTENANCE

Resources: To ensure that the appropriate resources are dedicated to support the technology on an ongoing basis. The support and maintenance plan will include some or all of the following:

- Support Hours/Contract
- Hiring of tech resources to manage it
- Assignment of staff member to take ownership
- Patches & Maintenance
- Ongoing Training

Upgrades: If the technology solution becomes mission critical, then a plan will be created to upgrade it. Technology tends to change dramatically every 3 years and should never be considered a one-time investment.

Outcome of Step 7: Stable & Efficient Technology


SELECTING THE RIGHT TECHNOLOGY VENDOR
RFP
$
TASK
Assess Feasibility
Gather Requirements
Research & Refine Options
Evaluate Vendors
Select & Engage Vendor
Manage Implementation
Support & Maintenance
OUTCOME
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Targeted List of Vendors/Solutions to Pursue
Vendor Proposals/Vendor Demos/Weighted Vendor Matrix
Final Vendor Selected & Contracted
On Time & On Budget Delivery of Expected Solution
Stable and efficient technology solution that empowers the organization

Information Technology: Opportunities

Future State How to Implement

1. Three Options: Turnkey System, Consultants, or Do-it-Yourself with On-site Engineering & Technical Support.

2. Recommendation: Use Wireless Telecommunications Consultant
   - Develop Systems Technology Committee, plus systems administrator

3. Built Relationship with Primary Equipment Vendors
   - IT needs to learn the system
   - Get hands-on experience with a few wireless links initially

4. Designed a Point-to-multipoint Dedicated Utility Wireless Network

- Include talks with all departments, design planning review with outside wireless telecommunications consulting and engineering support
- Use GIS for site location – elevation/distances, terrain & vegetation
- Initial field tests – test visibility of all sites, try a link at a time

5. Build Out in Small Steps – Phase 1

- Tower construction, Mast construction where needed
- Site installation, one site at a time
- System monitoring of work in progress

6. Phase 2 and/or 3

- Mesh network for mobile resources
- WiFi Hotspots

7. Installation Locations: Add-on to existing Towers

- Use existing towers where available i.e. water towers, light posts, utility poles, etc.
- Use care regarding interference to other users of existing facilities
- Use communications towers already in existence
- Consider including co-location on towers with communications companies
- No additional construction costs

8. Where needed, build new towers

9. Add masts to buildings

Understanding the key design parameters – Future State

- Current available spectrum includes: ___________________
- Antenna characteristics include: ___________________
- Number of multiple users that will share the available spectrum: ___________________
- Maximum bit rate and reach: ___________________
- Approach to providing backhaul from a wireless access point: ___________________
- Estimated price: ___________________

About iWire365

iWire365 is a Dallas based organization that combines wireless telecom infrastructure and business/IT application services in a “pay as you go” cloud and/or hybrid model, focused strictly on the rural cooperative and municipal utility markets. The iWire365 model mitigates capital and technology risks, while providing the lowest possible cost of service and the highest level of customer satisfaction.

For more information about our solutions and capabilities, please contact us today.

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